

CLAIMS

What is claimed is:

1. A tuning fork, quartz crystal resonator vibrating in flexural mode comprising;

tuning fork tines, and

a tuning fork base,

5 at least one groove provided in the central line portion of each of said tuning fork tines,

at least one first electrode provided inside each groove,

at least one second electrode provided on the sides of said tuning fork tines, and

10 for each tine said at least one second electrode having an opposite polarity to said at least one first electrode.

2. A resonator as defined in claim 1 wherein

the at least one first electrode inside the at least one groove of the first tuning fork tine and the at least one second electrode disposed on the sides of the second tuning fork tine are the same first polarity, and the at least one second electrode
5 disposed on the sides of the first tuning fork tine and the at least one first electrode inside the at least one groove of the second tuning fork tine are the opposite to the said first polarity.

3. A resonator as defined in claim 2 wherein said resonator comprises two electrode terminals.

4. A resonator as defined in claim 1 or claim 2 wherein the grooves constructed at the central portion including the central line of the tuning fork tines extend to the tuning fork base coupled to each tuning fork tine.

5. A resonator as defined in claim 1 or claim 2 wherein groove width W_2 constructed on the tuning fork tines are greater to or equal to the width from the edge of the groove to the edge of the tine W_1 , W_3 .

6. A quartz crystal, tuning fork, resonator vibrating in flexural mode comprising;

tuning fork tines,

tuning fork base,

5 a plurality of grooves provided on the tuning fork base where said base is coupled to the tuning fork tines, and

electrodes provided in said grooves.

7. A resonator as defined in claim 6 wherein

a first set of grooves are constructed on the obverse and the reverse faces of the tuning fork base where said base connects to each tuning fork tine, and

5 a second set of grooves are constructed on the obverse and the reverse faces between said first set of grooves.

8. A resonator as defined in claim 6 or claim 7 wherein
the electrodes disposed opposite each other in the thickness direction of the
grooves have the same polarity, and
the electrodes disposed opposite the sides of adjoining grooves have opposite
5 polarities.

9. A resonator as defined in any proceeding claim wherein the tuning fork
base has a plurality of grooves, and said grooves containing the electrodes.

10. A tuning fork, quartz crystal resonator vibrating in flexural mode
comprising;
tuning fork tines,
a tuning fork base,
5 said tuning fork tines having step difference portions,
with at least one first electrode on the said step difference portions,
with at least one second electrode disposed on the side of said tuning fork tines,
and
said at least one first and at least one second electrodes being of opposite
10 polarity.

11. A resonator comprising a plurality of resonators as claimed in any
preceding claim.

12. A resonator comprising as defined in claim 11 wherein said plurality of flexural mode, tuning fork, quartz crystal resonators are connected at each tuning fork base.

13. A resonator comprising;
a plurality of flexural mode, tuning fork, quartz crystal resonators being connected and formed integrally at each tuning fork base wherein said quartz crystal resonators are coupled to each other at the respective tuning fork bases and having an
5 angle of separation of 0° to 30°.

14. A resonator as defined in claims 11-13 wherein each of the plurality of tuning fork resonators have a different resonator shape and/or a different electrode deposition.

15. A resonator as defined in any of the claims 11, 12 or 13 wherein said resonators are arranged side by side.

16. A resonator as defined in any of the claims 11-15 wherein said resonators are electrically connected in parallel.

17. A resonator as defined in any of the claims 1-7, wherein the grooves constructed on the tuning fork tines and/or the tuning fork base are holes or a combination of the grooves and the holes, and said holes or said grooves and holes containing the electrodes.